Relationships between 'Wellness Centre' use, the surrounding built environment and obesogenic behaviours, Sunderland, UK

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ABSTRACT:

In the past two decades there has been a growing body of evidence that suggests the built environment influences people's propensity to lead (un)healthy lifestyles. Researchers have suggested that some environments may promote sedentary lifestyles, while providing access to large amounts of energy dense foods and as such these have been labelled 'obesogenic'. Further, the concept of Environmental Justice has been used to explain the disproportionate exposure to harmful environments by poorer communities and has recently been applied to the access of physical activity opportunities. The complex dynamics of how individuals interact with the built environment, in terms of physical activity and eating behaviours, however is still little understood. This paper is based on a pilot study which explored the use and location of six 'Wellness Centres' in Sunderland; a post-industrial city in the North East of England with high deprivation rates and a poor health profile. This work assessed whether the Centres are located in neighbourhoods which appear to be supportive, or unsupportive of particular aspects of healthy lifestyles; and further questions whether these characteristics are reflected in selected behaviours of the Wellness Centre users. Though this was a small study the research suggests that there were links between the type of neighbourhood and the lifestyles displayed by the Centre users. It proposes that the seemingly more active lifestyles of the inner city residents accompanied by lower mean BMIs, suggests that some neighbourhoods are more supportive of known aspects of healthy lifestyles than others and further these relationships not directly related to socio-economic status.

Background

The UK Government's Foresight 'Tackling Obesities: Future Choices' report predicted that by 2050 nearly 60% of the UK population may be obese (Foresight 2007). The report further stated that there is enough evidence to implicate the built environment in the obesity crisis and calls for health to be embedded in future planning and decision making. The dynamics of how the built environment may, or may not, encourage sedentary lifestyles and the consumption of excessive energy dense foodstuffs is not, however, well understood. The body of evidence, though large in volume is largely based in the USA and Australia where urban sprawl, of a type not found in the UK and Europe, has become a focus of particular concern; many studies are correlation, rather than cause and effect; the results are disparate and often seemingly contradictory; and while research has linked either physical activity, or food access, to the built environment, very few studies have linked all three and even fewer draw out a clear impact on health (Lake and Townshend 2006; Townshend and Lake 2009; Lake, Townshend et al. 2010; Townshend and Lake Forthcoming). The following sections briefly outline the key literature used in constructing the framework for the Sunderland study.

Environmental Justice, the Built Environment and Physical Activity

The overarching framework for this study was the concept of environmental justice. Environmental Justice has its roots in the US in the 1980s and was initially focussed on the concern that poorer communities had a disproportionate exposure to hazardous environments. More recently, however, it has become a framing tool for diagnosing

more wide-ranging environmental issues (McGurty 2000). For example, it has been used to explore access to outdoor recreation and resources (Whitehead 2000; Myron and Johnson 2002) and more recently access to parks and walkable neighbourhoods (Cutts, Darby et al. 2009) . Building on this approach the authors hypothesised that poorer areas in their study would have built environments which were less supporting of healthy lifestyle choices (based on research linking physical activity, food access and the built environment) than those areas of higher socio-economic status (SES).

Physical Activity and the Built Environment.

Studies exploring the links between the built environment and physical exercise are relatively well established (Humpel, Owen et al. 2002). Elements in the built environment which are seen to encourage physical activity (both leisure/sport and active travel i.e. walking and cycling) include; the provision of appropriate open spaces, (Giles-Corti, Broomhall et al. 2005) good accessibility to local amenities (King, Brach et al. 2003) pleasant urban design dimensions (Foster, Hillsdon et al. 2005); and land-use mix, (Be Bourdeaudhuij, Sallis et al. 2003). However, the research has not always been consistent, particularly across different groups in society, for example a recent study suggested that physical environmental factors were not a good predictor of physical activity for adolescents (Maddison, Vander Hoorn et al. 2009).

Some studies have focussed more on people's perception of the built environment rather than actual measurement, for example US studies, have suggested that certain groups such as older people and women are much more likely to be physically active

if they perceive their neighbourhood to be safe (De Bourdeaudhuij, Sallis J.F et al. 2003; King 2008) though this does not necessarily hold for younger men (Foster, Hillsdon et al. 2004). Research has also suggested links between increased levels of perceived access to opportunities for physical activity and more intensive use of them (De Bourdeaudhuij, Sallis J.F et al. 2003; Huston, Evenson et al. 2003); while other studies have linked perceived aesthetics of areas and people's willingness to exercise, either for recreation or utility (Carnegie, Bauman et al. 2002; Humpel, Owen et al. 2002).

It must be further noted, however, that even if built environment factors have been associated with increased physical activity this has not necessarily been tracked through to improved health outcomes. Taking just one measure of health, the propensity to be overweight, or obese, provides a good illustration. Some studies have shown a positive relationship between dense, walkable neighbourhoods and healthy weight at least in certain sections of the population (Frank, Andresen et al. 2004; Rundle, Roux et al. 2007); whereas others have shown no relationship at all (Rutt and Coleman 2005; Forsyth, Oakes et al. 2007; Pendola and Gen 2007) and some suggest a negative relationship (Stafford, Cummins et al. 2007). Provision of greenspace and 'greenness' generally within neighbourhoods has, however, been linked to reduced obesity prevalence and other health benefits (Ellaway, Macintyre et al. 2005; Groenewegen, van den Berg et al. 2006; Tilt, Unfried et al. 2007). Therefore, again the research is somewhat inconclusive.

Food and the Built Environment

Few built environment studies either looking at physical activity or food consumption have linked through to health consequences including adiposity. Food choices are made within the broader food environment (Burgoine, Lake et al. 2009). The food environment can be conceptualised to include any opportunity to obtain food, this encompasses physical, socio-cultural, economic and policy factors at both micro and macro-level (Townshend and Lake 2009). It includes food availability and accessibility in addition to food advertising and marketing (Lake and Townshend 2006). Research that links food choices to the built environment is still relatively undeveloped in comparison to research on physical activity and the environment. Alongside the exponential increase in the prevalence of overweight and obesity, has been a change in the structure of society in terms of the food environment, which changed rapidly in the UK over the last twenty years (Burgoine, Lake et al. 2009).

Evidence from North America and Australia suggests that lower- socio-economic status (SES) neighbourhoods and those with larger minority populations have greater exposure to fast-food restaurants and fewer healthy food choices (Black and Macinko 2008; Beaulac, Kristjansson et al. 2009). Some studies in the US have suggested that healthy foods may be more expensive in poorer neighbourhoods and this can be tracked to poorer diets (Rose and Richards 2004). In the UK, however, the picture is less clear (White, Bunting et al. 2004; Cummins and Macintyre 2006; White 2007). Further the role of fast-food availability in neighbourhoods is disputed with at least one US study suggesting a strong link between neighbourhood supply and increased obesity (Maddock 2004), however, this relationship has not been established elsewhere (Burdette and Whitaker 2004; Simmons, McKenzie et al. 2005). Understanding the complex relationship between the food environment and obesity offers great potential for developing interventions, policies (Wang, Gonzales et al.

2006; McLaren 2007) and ‘lasting solutions’ (Holsten 2009) to address the social phenomenon of obesity.

Case Study: Sunderland

Sunderland is the largest city by population in the North East region of England. A boom town in the 19th Century, the city has suffered great economic hardship due to the deindustrialisation of its core industries (shipbuilding and coalmining) and with it an increasingly poor health profile of the city’s residents has developed with a mortality rate 20% higher than the national average (Sunderland Partnership 2005). The city was chosen for study since it was highly accessible to the research team, high proportions of the population are overweight (51.7% of males and 30.9% of females) and obese (18% of males and 15% of females) (Sunderland Teaching Primary Care Health Development Unit 2004), 65% of the population fail to meet nationally recommended physical activity levels and the estimated annual cost of treating obesity is over £17.3m (Sunderland Teaching Primary Care Health Development Unit 2004); and the City has a wide range of built form within its administrative boundary, for example, 19th Century urban terraces, former mining villages, a 1960s new town (Washington) and typical contemporary suburban development. The city further reflects the links between low socio-economic status (SES), obesogenic environmental factors highlighted by previous research (Swinburn and Egger 2004; Macintyre, McKay et al. 2005; Nelson, Gordon-Larsen et al. 2006) and obesity in the de-industrialised areas of England (Moon, Quarendon et al. 2007).

In recognition of Sunderland’s poor record on health, six Wellness Centres as part of an overarching ‘Wellness Concept’ (Sunderland Partnership 2005), have been

established as a partnership project between Sunderland City Council and Sunderland Teaching Primary Care Trust. These centres are gym-based/exercise class amenities located in existing council run facilities at various locations spread throughout the city and supported by £2.3m of central government regeneration funding (Sunderland Partnership 2005) the locations are; Houghton, Puma, Bunnyhill, Seaburn, Crowtree and Washington. The locations, as outlined below varying considerably in terms of their SES (detailed below), therefore fitting the authors' environmental justice framework. Further, users from the Wellness Centres were targeted for the research from the perspective that these users were already demonstrating an interest in their health and would, therefore, be more likely to respond to opportunities for healthy behaviours supported by the local environment than a more general cross section of the population.

It is not possible to outline in detail all the neighbourhood locations for each of the Wellness Centre, but worthwhile highlighting some key issues; further using Indices of Multiple Deprivation (IMD) scores based on ONS statistics, an indication of the SES of each neighbourhood is given (Noble, McLennan et al. 2008). Crowtree, for example, is an inner city location adjacent to the City's main shopping area, university buildings, within easy reach of a residential area of 19th Century terraces and the city's main railway station, metro and bus routes. The whole district has been continuously developed since the early 19th Century; Crowtree is in the top 5% most deprived neighbourhoods in England. Washington, in complete contrast, is outwith the traditional city limits and was designated as one of the last generation UK 'new towns' in 1964 (Holley 1983). Designed by Llewelyn-Davies on the basis of a square-mile grid with a series of 'villages' linked by separated high quality pedestrian routes

fig 1 and roads, it was designed with full car ownership in mind (Holley 1983). Here the Wellness Centre is part of a larger sports complex on the edge of a park; Washington Wellness centre is located in top 45% least deprived neighbourhoods. Interestingly the density of housing development in the areas immediately surrounding both centres, though of vastly different form is similar at around 40-45 units per hectare, however, the Washington housing has a smaller footprint allowing for more private and semi-private space and is car orientated, figs 2 & 3. Many of the properties in Crowtree are houses in multiple occupation effectively pushing the per capita density much higher.

Of note in relation to the other centres, Seaburn is on the coast with a seafront location for its Centre, it is also one of the most affluent areas of the city, in the top 25% least deprived neighbourhoods. Bunnyhill, like Crowtree is another deprived area of the city, again the top 5% most deprived neighbourhoods in the country. Comparing the SES of the two areas is, for example, clearly reflected in the percentage of owner occupied properties at Seaburn 92%, at Bunnyhill just 42% (Sunderland City Council 2007). Houghton and Puma are located in socio-economically middle ranking districts with a mix of terraced and semi-detached housing typical of the region; owner-occupation rates of 62% and 63% respectively, both are in the lower half of the deprivation league, but outside of the of the 30% most deprived neighbourhoods (Sunderland City Council 2007).

Methods

This study was both exploratory and experimental. It sought to explore the built environment in relation to both physical activity access to fast food and further to use

self reported Body Mass Index (BMI) as an indicator of health outcomes in Wellness Centre users. This approach builds on previous attempts to understand 'obesogenic environments' i.e. those environment which may contribute to the rise in global obesity (Swinburn, Egger et al. 1999; Lake and Townshend 2006; Townshend and Lake 2009). Studies exploring obesogenic environments have employed a range of environmental audit tools that vary in scope and focus (Moudon and Chanam 2003). Most studies, as reviewed in the first part to this paper, aim to assess either subjective measurements i.e. perception, or objective measures. Both approaches have benefits and limitations, Brownson et al for example, suggest that as it is unclear which environmental variables 'provide more explanatory power' the use of triangulation and multiple methods of data collection is recommended (Brownson, Chang et al. 2004). To this end a mixed methods approach was attempted in this study. Two instruments were developed for the Sunderland study; 1) an environmental audit tool (OEAT) which sought to provide objective measures (based on those issues highlighted in extant research, density, connectivity etc) of the environments surrounding the Wellness Centres and 2) a questionnaire survey (PABE) which collected both qualitative and quantitative data relating to perceptions of the areas from centre users, along with self-reported heights and weights (allowing BMI to be calculated) and behaviours relating to physical activity and fast food consumption. Data collection in this cross-sectional study was from mid-May to mid-July 2007.

The development of the Obesogenic Environmental Audit Tool (OEAT) involved a review and analysis of 13 environmental analysis tools from the UK, USA, Australia and Netherlands, outlined in table 1. The Sunderland OEAT drew heavily upon an expert audit approach based on a checklist format. While questions, content and

subjects were drawn from the Irvine-Minnesota Inventory, PEDS and SPACES (Pikora, Bull et al. 2002; Boarnet, Day et al. 2006; Day, Boarnet et al. 2006; Clifton, Livi Smith et al. 2007) the scoring system was adapted to the UK context. A higher score indicated a higher incidence of built environment characteristics thought to contribute to obesity. The surveys were carried out on Saturdays in early Summer 2007 (in theory the busiest day to observe interaction with the environment and minimising the adverse influence of the region's weather) on three randomly generated 200m segments of the main access routes to the Wellness Centres and within a 1000m radius (10 min walking) distance of the Centre itself. Initially it was expected that the OEAT would be used as a measure for the Wellness Centre user's home environment as well as their exposure around the Wellness Centre. However, as illustrated by the PABE results, many wellness centre users came from some distance away, thus any attempt to directly relate the PABE and OEAT findings are of limited use. However, results from the OEAT are discussed in relation to the immediate foodscape surrounding the Wellness Centres as they have an interesting association.

The Physical Activity and the Built Environment (PABE) questionnaire was developed from an existing tool DEPA (Diet, Environment Physical Activity) (Lake, Townshend et al. 2009), a UK development of the 'Neighborhood Environment Walkability Scale for Youth (NEWS-Y)' (Rosenberg, Ding et al. 2009). The PABE questionnaire was developed to be context specific to the Sunderland Wellness Centres and was subjected to pre-testing using cognitive methods (Jobe 2003) within a focus group format. The PABE questionnaire contained 21 closed (Likert scale) and 3 open-ended questions. Open ended questions were analysed using the Framework approach (Ritchie and Spencer 1994). A researcher attended the Wellness Centres

between 16.30 and 19.00 on random weekday evenings, the busiest time for gym usage and collected surveys from consenting adults.

Results

Eighty users (36 male, 43 female, one non-disclosed, mean age 30.1 years, range 18-58 years) completed the questionnaire; each self-defined themselves as living in the target area for the Wellness Centre. Data was analysed with SPSS Version 14, using independent t-tests or ANOVA to compare means, followed by Bonferroni post hoc test ($p<0.05$). Chi-squared (χ^2) testing was used to compare variables. Seventy-eight recorded their self-reported height and weight, and BMI was calculated. The mean BMI was 24.27 (range 18.68 to 31.01). In relation to BMI and Wellness Centres an ANOVA indicated a significant difference between the six groups, $p=0.047$; Boneferroni post-hoc analysis showed a significant difference between Seaburn and Washington ($p=0.023$). Seaburn has the highest SES of the areas studied; it is also the only coastal location with direct access to a beach.

Most (n=69) participants reported being physically active on three or more days of the week. There were no statistically significant differences in employment status by area, or by gender. There was no statistically significance difference in the number of days of reported physical activity in the previous week by area. However, an ANOVA analysis indicated a significant difference between reported physical activity in the previous week and employment status ($p=0.036$). Those who were unemployed reported being physically active on a higher number of days.

The questionnaire gave options for respondents to choose *why* they used each particular Wellness Centre. The most frequent reason given was nearness to home (48%; table 2). This is unremarkable; however it becomes more interesting when compared to mode of transport used. The most frequent mode of transport was private car (n=49, table 3). Twenty-two respondents suggested they most frequently walked to their Wellness Centre. Fifty-five respondents never walked (table 2), for most distance was an issue (55%). Twenty-seven respondents estimated how far, 'too far' equated to in minutes of walking. The shortest time was 15 minutes, approximating to 1500m. While people therefore chose to attend their nearest Wellness Centre, for many this may not be within what might be considered reasonable walking distance.

By area, there was a significant difference in most frequent mode of transport to Wellness Centre. Walking to Crowtree exceeded other centres (χ^2 =30.00, p=0.012; table 3) suggesting that the environment around the Crowtree centre was most conducive to walking. The higher level of walking associated with the Crowtree Centre was of further interest when related to perceptions of crime and safety. In the dense urban location of Crowtree, most users walked to their Wellness Centres even though they had the highest concerns about crime and safety in the area. Conversely though concerns about crime and safety were lowest at Seaburn and Puma these had the highest proportions of car users.

There were also interesting relationships between perceptions of access to, and quality of, public open space and its use (table 4). Respondents suggested that Washington had the most accessible and best maintained greenspaces, whereas those in Bunnyhill had the worst, followed by Crowtree. When related to whether members engaged in

physical activity in these spaces (the numbers themselves being remarkably low) it was members in Crowtree who stated they used their greenspaces the most. Conversely members at Washington, despite claiming their spaces were accessible and well-maintained, suggested they used them no more than Bunnyhill, the area with poorest provision. The use of poor quality open space at Bunnyhill may well be related to the poor SES of the area, since at least open space use is essentially 'free'. The comparison of intensive use in urban, dense Crowtree and low use in suburban Washington is also interesting; with the suggestion that in these cases need may be a stronger driver of open space use than the provision of high quality spaces.

The Foodscape

The foodscape observations using the OEAT survey indicated that Crowtree had the highest clustering of fast food outlets, whereas Washington and Puma had no fast food outlets in the segments studied. This was supported by respondent perceptions of the foodscape from PABE, with nine Washington respondents stating that they did not pass any fast-food outlets on the way to the gym and only one stating they passed more than six. At Crowtree most respondents reported passing at least one fast food outlet and four passed more than six. However, when asked if they ate at fast food restaurants, in Crowtree 23% said they never ate at them at all and 67% said they never ate at one after using the centre. At Washington 25% said they never ate at fast food restaurants and 63% said they never ate at one after using the centre. The highest reported consumption of fast-food with one or more take-aways per week (67%) was Bunnyhill, which is interesting given its high deprivation status.

Discussion

This study has shown that in a relatively small sample of Wellness Centres in six different urban areas there were distinct differences in the user's perceptions of the environment, objective measures of the environment and self reported BMI. While the sample size of this pilot study is small there were a number of significant findings. A larger sample size may produce significant results in other areas. While the respondents were already physically active, in that they attended a Wellness Centre, it was interesting that 62% most frequently used cars to travel to the gym.

Proximity to beaches has been highlighted by Australian research (Giles-Corti and Donovan 2003) as contributing to people's physical activity and health. At Seaburn, both SES and beach access may have contributed to lower reported BMI (22.5). The relatively low mean BMI at Crowtree, the dense, mixed-use, inner city area with the highest walking associated with Centre use, and high greenspace use, supports the theories that mixed-use, dense urban location may encourage more active travel (Rundle, Roux et al. 2007). The highest BMI was at Washington (26.6), the most suburban in nature of the areas studied, supporting theories that these areas may not be as supportive of a physically active lifestyle as other locations (Frank, Schmid et al. 2005; Ewing, Brownson et al. 2006).

In terms of SES and access to open space, this study does broadly support a Environment Justice position with those in higher SES neighbourhoods such as Washington and Seaburn perceiving their greenspaces to be of higher quality that those in low SES locations like Crowtree, however as demonstrated this does not translate into intensity of use.

The findings relating to SES, crime and safety and active transport were mixed and contradictory. The users in Crowtree, who reported the highest concern about crime and safety, most frequently used walking as a method of transport to the Wellness Centre. This supports the Environmental Justice perspective than those in poorer areas perceive greatest exposure to crime, but more interestingly challenges the concept that there is a direct link between perceptions of crime and safety and walking for transport in the UK context (Allender, Cowburn et al. 2006). The users in Houghton, however, who also expressed high concerns about crime and safety, used their cars more regularly which supports the notion of a confused picture which has been highlighted previously (Jones, Bentham et al. 2007).

Research has suggested that physical activity may act as a 'gateway behaviour' for other health related behaviours such as healthy eating - yet the evidence remains inconclusive (Dutton, Napolitano et al. ; Dutton, Napolitano et al. 2008). In this convenience sample of Wellness Centre users, 46% were consuming three or more portions of fruit and 55% were consuming three or more portions of vegetables per day. This is higher than the Great Britain average where most men and women consume fewer than three portions of fruit and vegetables per day (Henderson, Gregory et al. 2002). Across all the centres the reported consumption of fast food was extremely similar even though observed and reported fast food outlet availability were vastly different. This suggests at least for these Wellness Centre uses, the presence of fast food outlets did not necessarily determine their use. Across all the Wellness Centres the numbers who stated they never ate at fast food restaurants after visiting

the Centre remained relatively consistent which suggests a tentative link between this behaviour and gym use.

It is interesting to speculate why there appears to be a suggested link between physical activity and the built environment (Jones, Bentham et al. 2007) and yet few links seems to be suggested between foodscape and the built environment. This may be related to the scale at which the dynamics are being studied. In Washington, for example, though the study looked at a 500m radius segment, the whole town is in fact designed on the same principles, thus the influence may not be at small neighbourhood level, but at the level of the town and beyond, since many residents will live in Washington and work in Sunderland. The key issue is that its car friendly provision facilitates car dependence and this may indeed encourage sedentary behaviour and related health consequences. In the case of Crowtree the inconvenience of car ownership and associated use in the inner city may mean that the immediate neighbourhood has a more significant influence on behaviour especially physical activity. The impact of fast food restaurants may equally operate at different scales, therefore though there appears to be a cluster in Crowtree if all the drive-through and car orientated restaurants were taken into account for the Washington residents the overall provision levels may be similar for both groups. The recent Cross-Government strategy for England on Obesity (Department of Health 2008) has indicated, among other strategies, that planning regulations will be reviewed in relation to the 'proliferation of fast food outlets in particular areas'.

Future work plans to validate both these tools and test them in different urban locations. This study has undoubtedly generated more questions than answers. It is,

however, part of an on-going programme of studies based in North East England and in particular looking at the influence of the environment on energy balance in young adults. This work is beginning to identify some important indicators about the various dynamics at work, but there are also recurrent themes that emerged from the other studies. The first is the urgent need to undertake more UK specific research and to development UK context specific measures in relation to the built environment and planning policy. More importantly there is a need for a greater understanding of what is meant by an individual's environment, especially since most individuals engage with multiple environments such as; their home neighbourhood, their place of work and where they shop. In reality, spheres of influence on specific behaviour, food consumption, active and non-active travel, and physical activity as recreation operate at different spatial levels. The understanding of these complex lifestyle behaviours requires a great deal more elucidation.

Conclusions

While limited in its scope, this UK study supports the growing body of research which suggests that factors within the built environment can combine to create neighbourhoods which are more, or less, supportive of healthy lifestyles. Also while it broadly supports an Environmental Justice perspective in terms that poorer neighbourhoods appear to environments associated with less healthful lifestyle choices, this does not always track through to individual behaviour. The results further suggest that scale and spatial distribution of the 'salient environment' varies between individuals and this adds a unique challenge to the study of built environments when outcomes are measured at the level of individuals who interact with those environments. It strongly supports, therefore, the need for further trans-

disciplinary research into the impact of contemporary urban design on both the cause and prevention of obesity.

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Tables

Table 2 - Reason for use of the Wellness Centre (n=79) and reason for not walking to Wellness Centre (n=55)

Reason for using centre	Number (% of total)	Reason for not walking	Number (% of total)
Near home	38 (48)	too far	30 (55)
Near work-place	17 (22)	exercise at gym/no need to walk	14 (26)
Near school/ college	1 (1)	unsafe	2 (4)
Value for money	3 (4)	unpleasant/un-enjoyable route	2 (4)
Like the exercise facilities	18(23)	Other	7 (13)
Other	2 (3)		

Table 3 - Mode of transport regularly used to Wellness Centre (n=79)

Wellness centre	car	walk	public transport	bicycle
Washington	9	2	3	0
Crowtree	5	12	3	1
Seaburn	10	4	0	0
Houghton	9	0	1	0
Puma	12	1	0	0
Bunnyhill	4	3	0	0
Total	49	22	7	1

Table 4 - Greenspace: perception and use (n=80) and perception of crime and safety by Wellness Centre

Location	Are spaces accessible? mean rank score*	Are spaces well-maintained? mean rank score*	combined overall greenspace mean rank score	% (no.s) of well using green spaces	Are there concerns about crime and safety? mean rank score*
Washington	3.4	3.4	6.8	14% (n=2)	2.0
Crowtree	2.7	2.6	5.3	33% (n=7)	2.8
Seaburn	3.4	2.7	6.1	14% (n=1)	1.7
Houghton	3.4	2.9	6.3	10% (n=1)	2.6
Puma	3.1	2.6	5.7	29% (n=4)	1.6
Bunnyhill	2.6	2.4	4.6	14% (n=1)	2.4

* Rank score: 1=strongly disagree, 2=somewhat disagree, 3=somewhat agree, 4=strongly agree.

Table 5 – Reported number of fast-food outlets passed on the way to the Wellness Centre

Location of Wellness Centre	none	one-two	three-five	six-nine	ten plus
Washington	9	2	2	1	0

Crowtree	4	5	8	3	1
Seaburn	5	5	4	0	0
Houghton	1	3	3	1	2
Puma	3	4	4	2	0
Bunnyhill	5	0	2	0	0

Table 1 - Summary of 13 environmental analysis tools from the UK, USA, Australia and Netherlands

	Type*	Tool Name	Country	Research Goal	Assessment Criteria	Assessment Technique
1	CMA	Analytical Audit and Checklist Audit Tool (Hoehner, Brennan Ramirez et al. 2005)	USA	Determine relationship between street-scale and physical activity.	Designed to capture environmental attributes - transport, land-use, aesthetics and social environment.	Two audit tools used: Analytical tool to be used by researchers and the checklist tool for use of community members.
2	SCA	DIY Community Street Audits (Living Steets 2002)	UK	Developed to audit the quality and walkability of local environments.	Examines eight audit categories e.g. footway surfaces and obstructions; Facilities and signage etc.	Tool is designed to be used by community. Auditors walk in groups, making objective comments/ observations and suggested improvements.
3	CMA	Environmental Supports for Physical Activity Questionnaire (Kirtland, Porter et al. 2003; Brownson, Chang et al. 2004)	USA	Determine perceptions of physical activity in the built and social environment.	Walking Behaviour; social environmental factors and physical environment features.	Telephone questionnaire. Results validated by GIS, walking behaviour was analysed using univariate and multivariate tests.
4	OEA	Irvine – Minnesota Inventory (Boarnet, Day et al. 2006; Day, Boarnet et al. 2006)	USA	Expanding on existing audits to include more built environmental features.	Measures built environment characteristics which are related to active travel.	Observers conduct independent surveys by walking through each area. 178 questions, assessed on a scoring scale.
5	SCA	Neighbourhood Environment Walkability Scale (NEWS) (Saelens, Sallis et al. 2003)	USA	To determine perceptions of design features related to physical activity	Types of residence; stores/facilities proximity; perceived accessibility; street characteristics ; etc	98 questions designed to gauge subjective measurements by residents. Answers then subject to scoring and analysis.
6	OEA	PARA – Physical Activity Resource Assessment (Lee, Booth et al. 2005)	USA	Assessment of physical activity resources.	Assess type; features, amenities; quality and incivilities.	Check-box instrument which rates facilities as poor, mediocre or good.

7	OEA	PEDS- Pedestrian Environment Data Scan Tool (Clifton, Livi Smith et al. 2007)	USA	Address pedestrian concerns over walkability and safety	Environment; Pedestrian facilities; Road attributes; Walking/cycling environment; subjective assessment.	Street segments are assessed by trained surveyors, who assess feature in situ.
8	OEA	SOPLAY – System for Observing Play and Leisure Activity in Youth (McKenzie, Marshall et al. 2000)	USA	Provides objective data on physical activity during leisure opportunities	Accessibility; Usability; Supervision; Organisation of activities and Equipment.	Scans of play/ leisure facilities are conducted. Separate scans made for males and females. In each area predominant type of activity is recorded.
9	SCA	SPACE – Spatial Planning and Children's Exercise study (de Vries, Bakker et al. 2007)	Netherlands	To examine association between built environment and children's PA	Assess 54 features including e.g. type of residence; Sports facilities; Recreation facilities; etc.	Tool predominant based upon NEWS tool. SPACE tool was modified to reflect Dutch environment and factors relevant children. .
10	OEA	SPACES –Systematic Pedestrian and Cycling Environmental Scan (Pikora, Bull et al. 2002)	Australia	Measures environmental factors that may influence walking & cycling.	Assess 37 features including: Walking and cycling paths; Street Assessment of physical characteristics; etc.	Street segments are assessed by observers with a checklist for field data entry.
11	OEA	St. Louis Environment and Physical Activity Instrument (Brownson, Baker et al. 2001)	USA	Measures environmental influences on physical activity.	Assessment of walking behaviour; Places to walk; Barriers to physical activity; Place perception; etc	Data is collected via a 104 question survey conducted by telephone.
12	SCA	Twin Cities Walking Survey (Forsyth, Oakes et al. 2007)	USA	Examine perceptions of the built environment relation to physical activity.	Designed to measure quality of life; Perceptions of the neighbourhood environment etc.	Audits are conducted by local residents; tool has a questionnaire style format which allows for subjective measures to be assessed.
13	OEA	Urban Design Qualities Related to Walkability (Ewing, Handy et al. 2006)	USA	Assessment of urban design qualities related to walkability	Identifies five urban design characteristics associated with walkability.	Statistically derived equations are used to define and link objectively measured urban design features of the environment to ratings of urban design quality.

* Type: OEA = objective expert audit; SCA = subjective community audit; CMA = combined methods audit

Fig 1.

The network of pedestrian routes runs through high quality public space

Fig 2

Car dominated private housing Washington

Fig 3

Fig 3 Social housing, Washington, also designed around the needs of the car